Egypt, J. Plast. Reconstr. Surg., Vol. 41, No. 2, July: 291-294, 2017

Improvement of Skin Graft Take and Quality by Bioptron Postoperatively

AMIR ABDEL-KAREEM SAIDY, M.D. and MAURICE FEKRY, M.D.

The Department of Plastic Surgery, El-Mataria Teaching Hospital, Egypt

ABSTRACT

Material and Methods: This clinical study investigating the role of polarised-light therapy in the postoperative treatment of split thickness skin graft. In 10 out of 20 patients with split thickness skin graft , were treated with polarised-light therapy (400-2000nm, 40mW cm^2, 2.4Jcm^2) until complete closure.

Results: Evaluation revealed that treatment with polarised-light irradiation resulted in a significantly shorter healing time, with almost no hypertrophic scarring, and optimal aesthetic and functional results at long-term follow-up. No extension of the hospital stay was required. Polarised-light therapy may be a valuable way to obtain better results of skin grafts.

Key Words: *Skin graft – Bioptron.*

INTRODUCTION

Since 2014, twenty patients out of Fourty patients with split thickness skin graft were treated with polarised-light therapy, until complete closure at Oraby Burn and Oncology Hospital. A linearly polarised light source (Bioptron) with the following technical characteristics was used: Wave length: 400–2000nm; degree of polarisation: 95%; power density: 40mWcm^2; light energy: 2.4 J cm^2 (Fig. 1).

Fig. (1): A linearly polarised light source (Bioptron) wave length: 400-2000 nm; degree of polarisation: 95%; power density: 40mWcm^2; light energy: 2.4 J cm^2.

MATERIAL AND METHODS

Twenty grafts were treated according to the following protocol: Polarised-light therapy was given for 6min. daily at a distance of 10cm, and the grafts was then dressed with Vaseline gauze.

Standardized color photographs were taken every day. Phototherapy was continued after the wound had completely healed for 2 months.

This group of 20 patients consisted of 12 males and 8 females, with a mean age of 38.6 years (range: 3-65 years). The mean total body surface area burned was 14.4% (range: 2%-36%) and the mean area treated with polarized light was 10.2% (range: 2%-30%). The mean hospital stay was 18.1 days (range: 1-42 days).

The control group involved 20 patients consisted of 14 males and 6 females, with a mean age of 31.6 years (range: 1-57 years). The mean total body surface area burned was 12.8% (range: 4%-32%) and the mean area treated with polarised light was 12.6% (range: 4%-29%). The mean hospital stay was 28.6 days (range: 9-68 days).

Final long-term follow-up pictures of the 40 cases were shown. Comparison was done as regard time of healing and hypertrophic scarring and contractures.

RESULTS

The mean time to wound closure was 3.2 weeks (range: 2.1-5.5 weeks). There was no correlation between the estimated healing period and the actual time to complete wound healing.

The estimated time for healing was found to be significantly longer in those patients treated without Bioptron than the healing time of that treated with Bioptron, with mean values of 41 days and 22 days, respectively (Fig. 2).

Only one patient had hypertrophic scarring, who was not compliant in wearing pressure garments. This rate of hypertrophic scarring was significantly lower than that of the control group.

There was a significant difference between the mean hospital stay in this group of patients and that of the control patient population (mean: 18.1 days versus 28.6 days).

All observers expressed their surprise at the remarkably good function and pattern of the skin in the burned hand cases treated with Bioptron (Figs. 3,4,5).

Fig. (2):

Photo (A): Showing STSG at 3rd day.

Photo (B): Showing healing of the graft after 13 days.

Fig. (3):

Photo (A): Showing post burn scar.

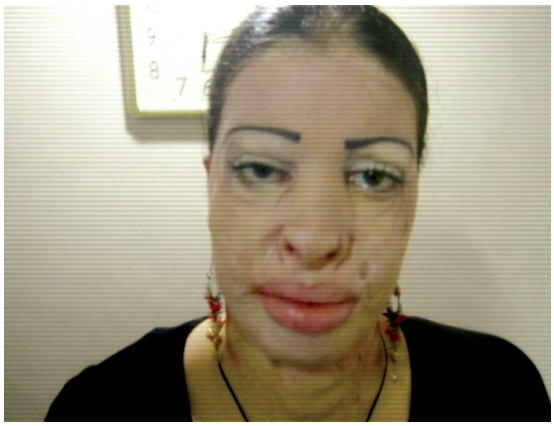

Photo (B): Showing post healing of the graft with good texture after Bioptron therapy for 3 months.

Fig. (4):

Photo (A): Showing post burn scar.

Photo (B): Showing post healing of the graft with good texture after Bioptron therapy for 2 months.

Fig. (5):

Photo (A): Showing post burn scar.

Photo (B): Showing post healing of the graft with good texture after Bioptron therapy for 6 months.

DISCUSSION

Several other authors have reported different biological effects after polarised-light irradiation, including stimulation of cell proliferation (especially in fibroblasts), release of growth factors and enhancement of collagen synthesis **[3,4-6]**. In accordance with the reordering of liquid-crystal molecules after light irradiation, linearly polarised light is thought to interact with the polar heads of the lipid double layer of the cell membrane, resulting in structural changes that influence the cellular processes connected with the cell membrane **[3,4,5]**.

The clinical reports of the use of polarised light in the treatment of STSG were very promising as it increase wound epithelialisation and improve tensile strength of scars **[1,2,3,7,8]**.

In order to establish the indications for using polarised-light therapy in burns, we first used this treatment in a pilot study of 40 patients with difficult wounds, such as deep burns, residual defects after grafting procedures using widely meshed skin grafts, we were impressed by the apparently beneficial effects of polarised light on the healing of these grafted wounds.

For this study, we selected 20 out of 40 patients with deep burn wounds that treated by meshed STSG. Evaluating the indications for traditional versus Bioptron and surgical treatment of deep burns and in predicting the development of hypertrophic scarring and contractures.

Moreover, they all significantly overestimated the healing period: The actual time to complete wound healing was significantly shorter (10 days versus 20 days). Moreover there was only one case of hypertrophic scarring, in a patient who was not compliantin wearing pressure garments.

All patients were submitted to the usual protocol of using pressure garments and silicone application, which is standard in our burn centre to prevent hypertrophic scarring. The study proved that, after treatment with polarised light, the application of pressure garments and silicone inlays could be started earlier and caused fewer problems with the just healed skin grafts (less blister formation and epithelial breakdown). We were, however, unable to confirm this clinical impression statistically.

Another major advantage of treating grafted deep burns of the hands with polarised light is that physiotherapy, which is started immediately, can be continued throughout treatment without interruption, in contrast to control group the grafted burned hands, which always require a period of immobilization. The promising results of polarised-light therapy in treating deep burns of the hand will be further investigated in a future clinical study.

Conclusion:

In conclusion, the results of this clinical study demonstrate that polarised-light therapy reduces the incidence of complications of grafted deep burns. In thisgroup of patients, the use of polarised light accelerated wound healing and allowed very early pressure therapy, thus reducing hypertrophic scarring and contractures. No extension of the hospital stay was required. Because of the better aesthetic and functional results (especially in burns of the hands), polarised-light therapy has become the therapy of choice for deep burns in our Hospital.

REFERENCES

1- Kana J.S., Hutschenreiter G., Haina D. and Waidelich W. Effect of low-power density laser radiation on healing of open skin wounds in rats. Arch. Surg., 116: 293-6, 1981.

2- Abergel R.P., Lyons R.F., Castel J.C., Dwyer R.M. and Uitto J.: Biostimulation of wound healing by lasers: experimental approaches in animal models and in fibroblast cultures. J. Dermatol. Surg. Oncol., 13: 127-33, 1987.

3- Fenyö M.: Theoretical and experimental basis of biostimulation. Optics Laser Technol., 16: 209-15, 1984.

4- Kertesz I., Fenyö M., Mester E. and Bathory G.: Hypothetical physical model for laser biostimulation. Optics Laser Technol., 14: 31-2, 1982.

5- Kubasova T., Fenyö M., Somosy Z., Gazsó L. and Kertész I.: Investigations on biological effect of polarized light. Photochem. Photobiol., 48: 505-9, 1988.

6- Bolton P., Dyson M. and Young S.: The effect of polarized light on the release of growth factors from the U-937 macrophage-like cell line. Laser Ther., 2: 33-42, 1992.

7- Stäcker A.D.: Förderung der Wundheilung durch Bestrahlungmit polarisiertem Licht. Medwelt, 3-7, 1986.

8- Stegmann W.: Behandlung des Ulcuscrurismitpolarisiertem Licht. Phlebol. Proktol., 14, 1985.